Trowbridge Dam Area

Introduction

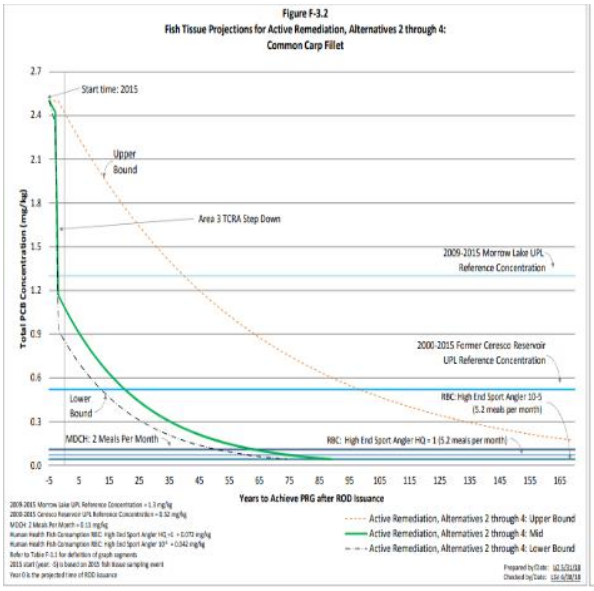
The "Trowbridge Dam Area" time critical removal action (TCRA) is ongoing, a revised set of designs was recently received, and construction has not started, so it would be premature to comment on the final condition. However, several State Agencies have participated in review of the design and the State has submitted several comment letters communicating our wide range of concerns about the unsafe and injurious conditions that would occur if the current design were implemented, which we contend would not protect human health and the environment or achieve our programmatic requirements (ARARs). Given the multitude of concerns EGLE has raised on the Area 4 Supplemental Remedial Investigation (SRI) Report and for the sake of available space in this document, EGLE will only briefly summarize our over-arching concerns for work being conducted by the removal program and our focus will be on those aspects that relate to or impact the development of remedial alternatives in the Feasibility Study (FS).

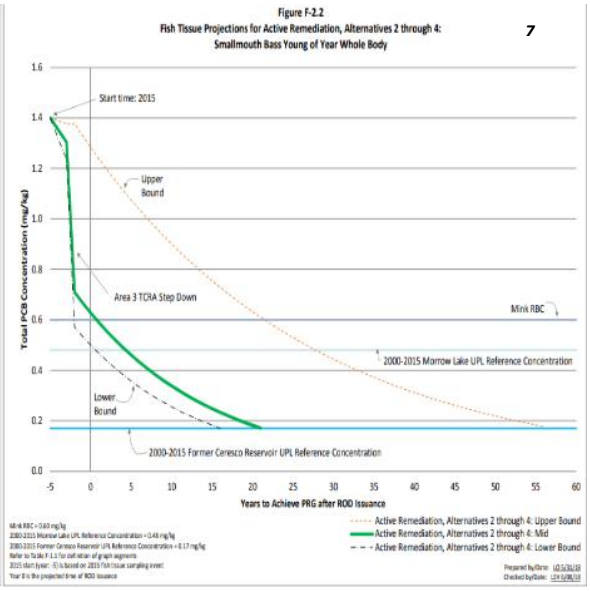
Background

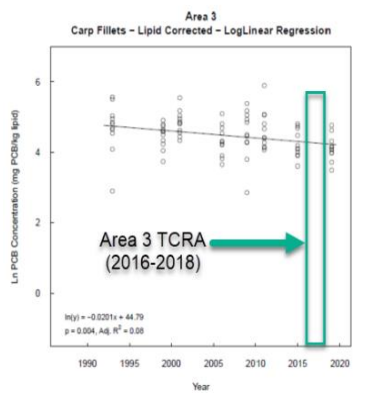
The Action Memorandum that was issued in April 2020 envisioned an *orderly transition* of the TCRA footprint to the remedial response program and required an evaluation of the residual risks in the "Trowbridge Dam Area" during the FS[1]. However, the FS, when submitted, will not include any Alternatives for the "Trowbridge Dam Area"[2,3] suggesting that no remedial alternatives will be developed during the FS and no further action will be conducted in that footprint, which is a management approach has also been utilized in other Areas of the river where removal actions have been completed[4,5]. The spatial extent of the removal action is also significantly smaller than what is shown in the Action Memorandum and work in several Subareas has been reduced or altogether eliminated[6].

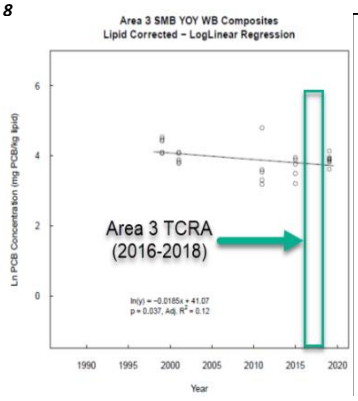
Discussion

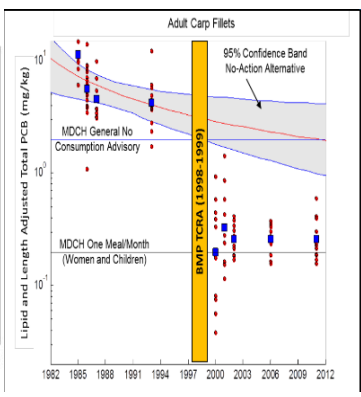
Projections are often made ahead of a remedial action, but the outcome is not predetermined.

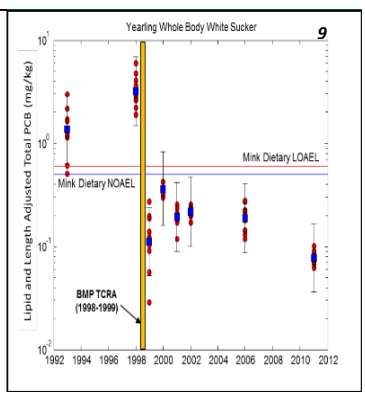












Monitoring of abiotic and biotic media at the Site following the completion of a few TCRAs has shown a wide range of outcomes are possible following completion of the removal action.

Ultimately, a robust assessment of abiotic and biotic media following completion of the removal action will be necessary to evaluate the effectiveness of the removal action and quantify residual risks. The FS should incorporate portions of the "Trowbridge Dam Area" that are no longer addressed as part of the removal action (i.e., all of Subarea H, most of Subarea's F and G, etc.). Upon completion of the removal action, the final removal footprint must be incorporated into the Area-wide FS or in a separate Focused FS to evaluate the effectiveness of the removal action.

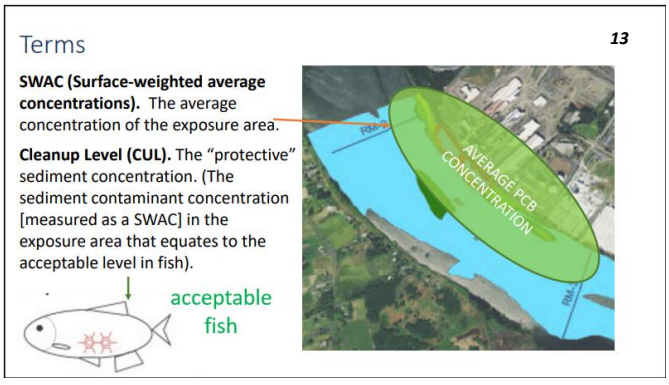
Alternatives for Sediments Outside the "Trowbridge Dam Area"

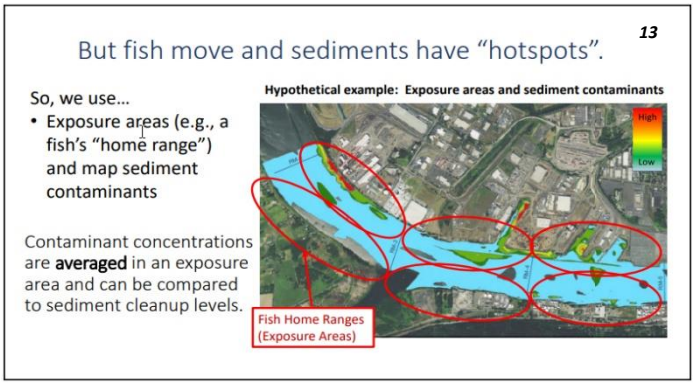
Introduction

A Total PCB (TPCB) surface-area weighted average concentration (SWAC) of 0.33 parts-per-million (ppm) is the proposed Preliminary Remediation Goal (PRG) to be applied as a clean-up level (CUL) over the entirety of Area 4 and achieved overtime[10], and the basis for the 0.33 ppm TPCB PRG is documented and detailed in the Human Health Risk Assessment (HHRA)[11]. Based on the selection and method of applying the TPCB PRG, the ASTM concludes that potential edge sediment excavation may occur outside the extents of the dam removal, but it would be limited to the area between RM47.5 and RM47. Applying a TPCB SWAC of 0.33 ppm as a PRG/CUL over the entire Area (or over an entire Subarea) to achieve Remedial Action Objectives (RAOs) will result in a significant amount of contaminated material being left behind. EGLE's position is that the approach used to calculate TPCB SWACs throughout Area 4 (and OU5) and determine that only limited sediment remedial action is necessary outside of the "Trowbridge Dam Area" needs to be revisited.

Background

Sediment SWAC calculation areas may be based upon human or ecological exposure areas, the home ranges of fish and/or other aquatic species, as well as differences in the river's flow rate, bottom profile or slope, velocity, or other distinct geomorphic reaches of the river[12]. Sediment CULs derived from fish tissue contaminant levels assume a fish exposure area, and we use that exposure area (e.g., a fish's "home range") to map contaminants and produce average concentrations over an exposure area that can be compared to CULs[13] over spatial scales relevant to the smallest relevant exposure pathway and receptor[14]. Utilization of a "moving window" analysis based on the smallest relevant exposure area may be preferred in the absence of physical barriers (i.e., current dams, impassable riffles, etc.) or other logical separations[14]. If SWACs are to be used as an exposure and protectiveness metric, then it is critical that they are appropriately derived and sized for the associated exposure pathway and receptor so that CULs are achieved over a relevant spatial scale(s)[15]. If SWACs are applied to areas much larger than discrete source or a receptors' exposure areas, then a SWAC analysis may not delineate a footprint appropriate for targeting sources or reducing exposure[16], and high concentration areas can be "averaged out" but still drive bioaccumulation and risk[14].





Receptors and RAOs

The RAOs proposed for Area 4 are generally consistent with RAOs established for other Areas[4,5,17]. Two RAOs proposed for Area 4 (RAO 1 and RAO2) utilize resident fish (adult and young-of-year smallmouth bass) as the receptor, both RAOs are achieved through removal of contaminated sediments and attainment of the 0.33 ppm PRG for TPCBs[10] and,

consistent with RAOs established for other Areas[5,17], EGLE expects that this PRG will be achieved upon completion of the remedial action. Smallmouth bass (SMB) age classes of interest for these RAOs are defined by total length, which ranges from 79mm to 119mm for young-of-year and 254mm to 356mm for adults[18].

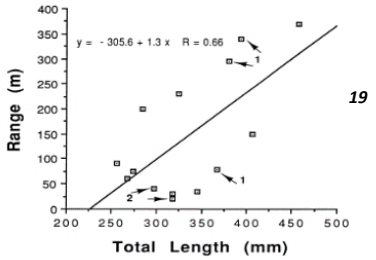
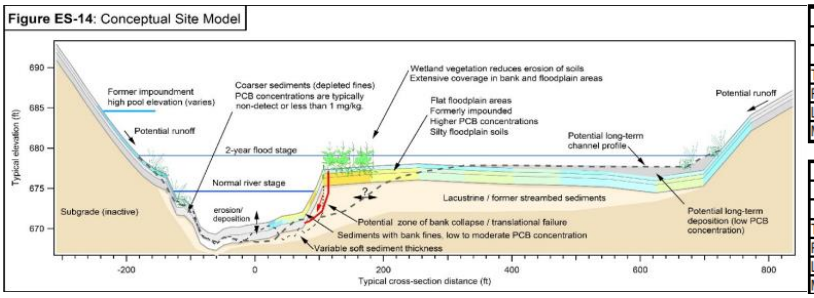


Figure 4. The relationship between total length and total range size for smallmouth bass tracked between May 1988 and November 1989. Each point represents either a spring/summer or fall/winter range. Two fish (1 and 2) were tracked for longer than one season; lengths were estimated for a typical growing season.

No site-specific studies have been conducted to look at movement of SMB within the Superfund site and a "homerange" has not been considered or developed, but information on a potential "homerange" for SMB is available in the scientific literature. SMB tracking studies conducted in riverine systems, including one study conducted on a river located in central Michigan that is very similar to the Kalamazoo River, have generally noted that SMB movements in these systems are fairly restricted - on the order of tens to hundreds of meters for juvenile and adult SMB - and observed that SMB may respect stream features (i.e., riffles or pools) boundaries.[19,20]

Area 4 SRI Sediment SWAC Development

Sediment SWACs for TPCBs were calculated for the eight sediment subareas that were established for Area 4 (Subareas A through H), including five in the main channel (Subareas A through E) over a distance of approximately 4.9 river miles, based on distinct dam-in geomorphological characteristics, the spatial distribution of PCBs in sediments, bank and floodplain soils, and areas of floodplain inundation[21]. SWACs were calculated across five sample intervals using TPCB data collected during the SRI, and calculations were completed for each Subarea using a channel-wide average approach and an approach that divided the main channel of each Subarea into a "Right Bank", "Left Bank", and "Middle Channel" in consideration of the conceptual site model.



SWAC - Interval 1 (0-6 inches)								
Entire Area 4: 0.87								
	Subarea A	Subarea B	Subarea C	Subarea D	Subarea E	Subarea F	Subarea G	Subarea H
Total	0.07	0.60	0.25	0.15	1.19	2.39	3.87	1.29
Right Bank	0.10	2.52	0.48	0.43	0.57	4.96	5.14	NA
Left Bank	0.12	0.44	0.34	0.10	3.64	1.61	3.40	NA
Middle	0.03	0.08	0.10	0.05	0.26	2.50	4.29	NA

SWAC - Interval 2 (6-12 inches)								
Entire Area 4: 2.14								
	Subarea A	Subarea B	Subarea C	Subarea D	Subarea E	Subarea F	Subarea G	Subarea H
Total	0.07	0.23	0.08	0.23	1.85	4.52	20.87	12.42
Right Bank	0.13	0.70	0.11	0.70	3.10	5.94	34.83	NA
Left Bank	0.09	0.11	0.05	0.11	3.96	2.26	27.77	NA
Middle	0.03	0.05	0.07	0.05	0.67	4.20	23.97	NA

Distribution of PCBs in Sediments in Area 4 and similar Areas of OU5

As is evident in the 1938, 1950, and 1967 aerial images[21] the influence of former Trowbridge Dam extended all the way to the former Otsego Township dam (approximately 4.9 river miles), and this resulted in extensive Area-wide contamination of the sediments and now-exposed floodplain soils. As riverbank and floodplain soils actively erode, contaminated materials settle along the river's edge and may then be transported further downstream and redeposit/re-suspend with the river flow[21]. The channel morphology is a controlling factor in the accumulation of PCBs in relatively thicker deposits along the channel margins, in point bars inside channel curves, or in areas where velocities may be slower and finer-grained sediment can accumulate[21].

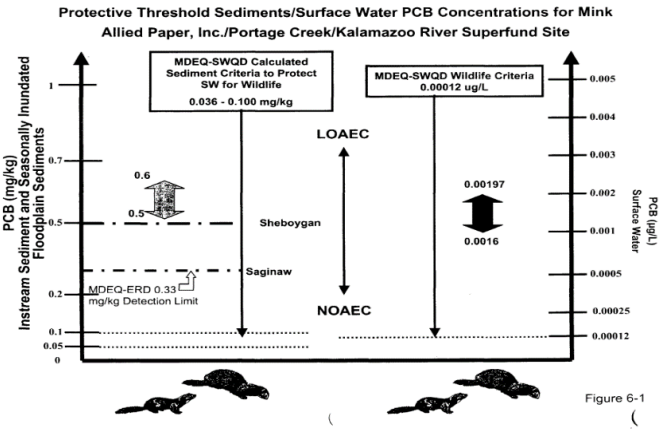
Maps of depositional and erosional areas, contaminant concentrations, and footprints selected for remediation during removal and remedial actions show that contiguous in-river sediment sources in "free-flowing" reaches are generally less than a mile in length, and the distribution of "hot spots" in surficial sediments within the main channel appears to be associated with bedforms which are generally on the order of tens to hundreds of feet in total length and hundreds to thousands of square feet in total area[22,23].

Discussion

As shown in the graphics from the HHRA that are inserted below, the range of risk-based concentrations (RBCs) for sediments (RBC_{sed}) calculated to protect the majority of anglers that consume resident fish were generally lower than

0.33 ppm. The basis for the selection of 0.33 ppm as a RBC_{sed} in the 2003 HHRA was that it was considered by the State to be a detection limit that could be reliably achieved in virtually all samples with PCB concentrations in the range of those commonly seen in riverine systems at the time the HHRA was written[11].

It could be argued that the 0.33 ppm PRG for TPCBs may be in the range of uncertainty for RBC_{sed} such that achieving a post-construction TPCB SWAC of 0.33 ppm will be protective of ecological receptors and sufficient to achieve the RAOs proposed to protect a high-end sports angler with a restricted diet, although more conservative values can also be justified. However, it is apparent the Subarea- and Area-wide scale over which the TPCB SWAC of 0.33 ppm is being calculated and applied is simply too large to evaluate receptor exposure and is based on geomorphic conditions that will not be relevant in the near future.



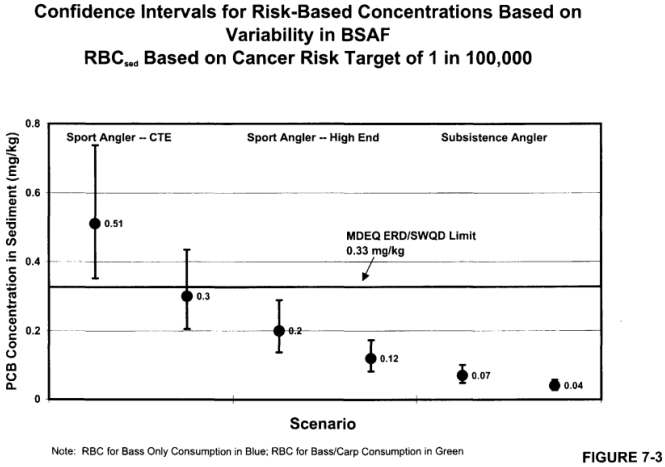


FIGURE 7-3

Floodplain Alternatives- Mapping the Total TEQ (TTEQ) and TPCB Remedial Footprints

Introduction

The information presented below and detailed in EGLE's comments on Area 4 documents should be incorporated into the FS to avoid the underdevelopment of floodplain alternatives and gross errors in remedial footprints for TPCBs and TTEQ.

EGLE's position is that the ordinary kriging (OK) model and natural neighbor model (NN) used to produce TPCB remedial footprints in the SRI and ASTM are fundamentally flawed and should not be relied upon for comparing remedial alternatives in the FS, and that analysis is detailed in a formal report[34]. EGLE believes that the 55 acre estimate for the TPCB remedial footprint is likely the lower bound of what may be encountered when new data are collected for remedial design and apparent analytical biases are resolved. At a minimum, we see the 116 acres we estimated from the combined RI and SRI data as a reasonable estimate (Table 2) but also believe that this may not be an upper bound. A reasonable upper bound would include the "correction" of the SRI data that is biased low, which is further discussed in The Compounding Issue of PCB Bias section, which would result in TPCB remedial footprints that range from 148 acres (25% correction) to 206 acres (100% correction).

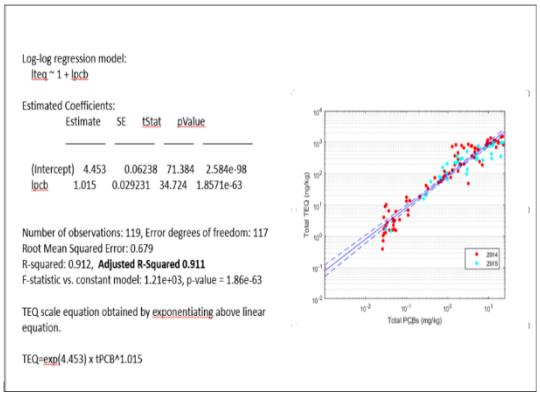
Table 2. Model Fit and Area Estimates for PCB Concentration Exceeding 11 mg/kg Total Aroclors

	Kriging Model		Natural Neighbor Model	
Data Subset	Mean Absolute Error (mg/kg)	Area with PCB > 11 (Acres)	Mean Absolute Error (mg/kg)	Area with PCB > 11 mg/kg (Acres)
SRI-Only	2.9	54.6	2.9	74
SRI+RI	4.7	45.6	5.1	116

EGLE's position is that the number of TTEQ sampling locations is inadequate to define the nature and extent of contamination in the floodplains or develop a reliable map without additional data or leveraging TPCB and TTEQ correlations. The Responsible Parties (RPs) have previously stated their preference for collecting and utilizing empirical data in lieu of using correlative relationships to map the TTEQ footprint[24]; however, no additional data collection is planned during the FS.

Background

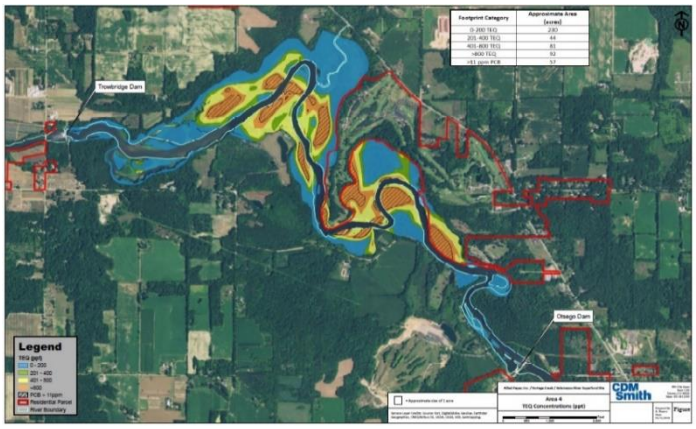
Accurately determining the area of formerly impounded sediments with TPCB concentrations exceeding the 11 ppm PRG is a key component SRI and FS, and generally speaking the TPCB remedial footprint size and corresponding remedial cost are approximately proportional to the area exceeding 11 ppm TPCB.

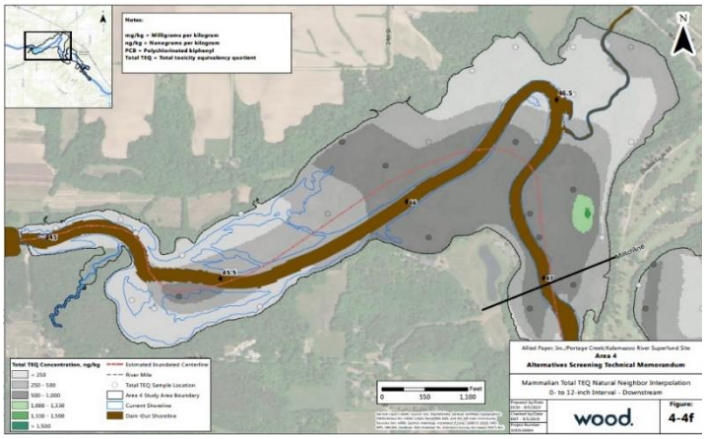


The SRI and ASTM use a limited number of sample locations (55) to interpolate TTEQ concentrations over an area of more than 489 acres. The approach being applied refuses to acknowledge that that sparsely sampled TEQ values can be leveraged by exploiting the relatively strong (R^2=0.91) relationship between TEQ and PCBs which were measured at much more dense spatial scale. EGLE (formerly MDEQ) developed statistical relationships between co-located TPCBs and TTEQ, and preliminary uncertainty analysis, and presented this to the USEPA and the RPs early on in the development of the Area 4 SRI Report[25].

Discussion

A comparison of TTEQ and TPCB maps and acreages above thresholds of interest using the approach in the SRI and ASTM to the approaches proposed by EGLE show large differences in the total acreages, geometry, and even spatial location of potential remedial footprints.





For the TTEQ interpolations, the FS should provide evidence of the assumed spatial correlation in TEQ measurements is adequate to support the NN interpolations. There should be a quantitative evaluation based on cross validation estimating the uncertainties in the mapped footprints based solely on the TTEQ measurements and a comparison with those to an interpolation based on a combination of measured TTEQs and estimated TTEQs based on TPCBs. One method for integrating these data could be based on co-kriging which the project team has successfully used in the past to integrate multiple data sources for delineations.

For the TPCB interpolations, the OK model presented in the SRI/ASTM should not be relied upon for comparing remedial alternatives since it is fundamentally flawed and fails to follow basic order relationships. EGLE's anisotropic NN model is likely to represent field conditions more accurately because it preserves the short scale continuity, while the OK model breaks down because it is based on inappropriate semi-variogram models, and the data do not satisfy the parametric assumptions of second order stationarity.

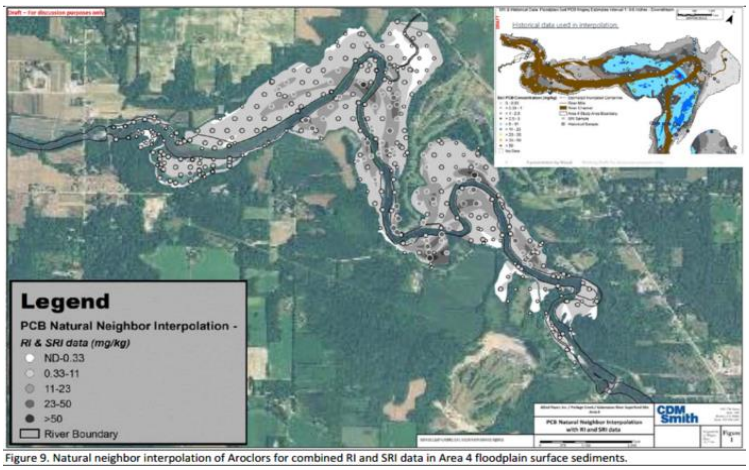
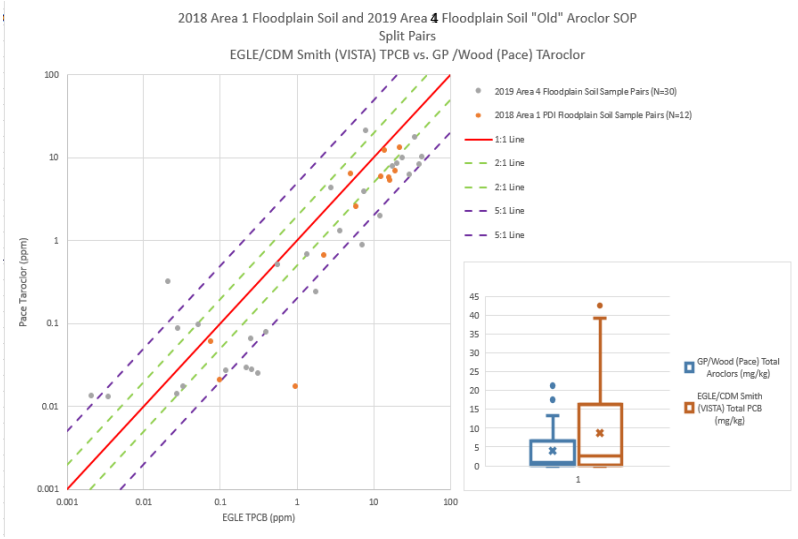


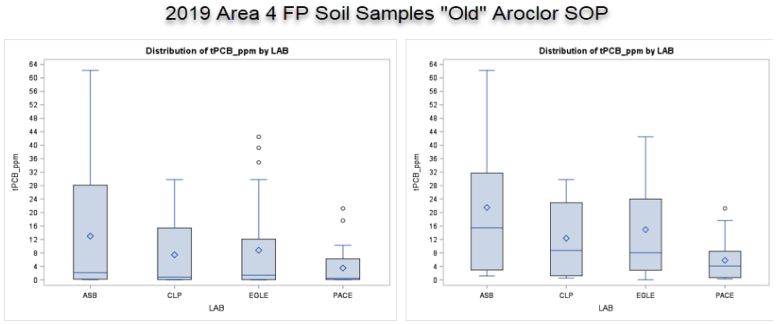
Figure 9. Natural neighbor interpolation of Aroclors for combined RI and SRI data in Area 4 floodplain surface sediments.

The Compounding Issue of PCB Bias

Introduction

EGLE believes that a documented low bias in TPCB Aroclor measurements from the RPs lab (Pace) in the SRI data needs to be addressed in order to adequately evaluate remedial alternatives for the floodplain and sediment remedy. EGLE's position is that either issues related to data usage need to be resolved before the FS is completed for Area 4, or that the FS explicitly incorporate these uncertainties in a rigorous error analysis including scenarios reflecting the potentially corrected data set(s). This issue directly impacts EGLE's ability to support conclusions presented in the SRI Report, the Alternatives developed during the FS based on those conclusions, and the selection of an FS Alternative as a proposed remedy.



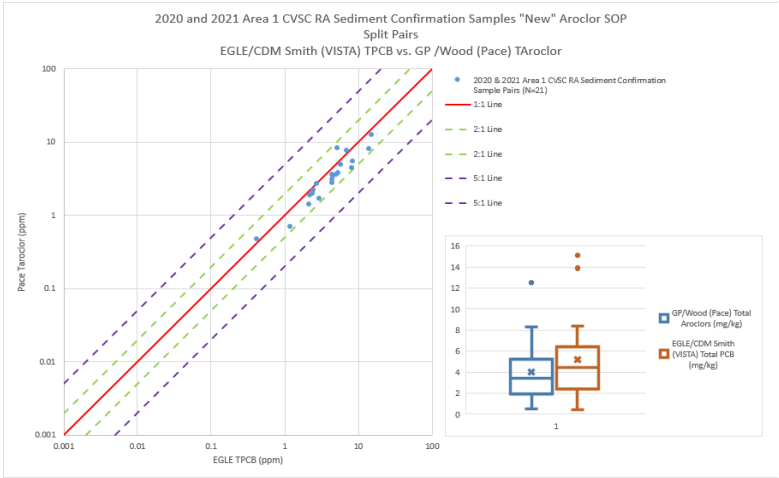


Figures 1a and 1b. Box plots of the results for each lab: 1a-All results, 1b-Samples where all lab's results are > 1ppm.

Background

The potential for issues with quantitation of TPCBs using the Aroclor method (M8082) due to *weathering* is discussed in the Method[26], well known within the scientific community[27], discussed in US EPA guidance[28,29], has been encountered at other Superfund sediment megasites[30], and was mentioned as a potential issue during a previous remedy review conducted for an upstream Area of this site[31].

A low bias in TPCB Aroclor measurements from the lab that has generated the majority of SRI/FS data at the Kalamazoo River Site (Pace), including the 2014 and 2015 Area 4 SRI data, was first identified in Area 1 in 2018 and further explored during a small, supplemental investigation in Area 4 in 2019. Preliminary evaluations of those datasets were completed by the US EPA and EGLE are summarized and documented in work products[32,33,34] and comment letters[35,36], and a few figures from those efforts are inserted above to illustrate the magnitude of this issue. Following discovery of the significant low bias at the primary lab as well as issues in M8082 measurements from other labs that were also evaluated, corrective actions were taken to address the suspected root cause(s) of these differences and a "new" site-specific SOP for M8082 was adopted which as shown in the figure below has improved but not fully resolved the PCB quantitation issue under M8082.



Additionally, EGLE sought to understand the potential impact of a low bias in TPCB measurements based on M8082 results from the lab in question and requested that our contractors, CDM Smith and Kern Statistical Services, evaluate changes that would occur to the TPCB remedial footprint if the SRI data were "corrected", and those efforts are summarized in a formal report[34]. EGLE's analysis shows that PCB remedial footprints modeled using SRI data are very sensitive to modest and reasonable correction factors based on the degree of observed bias in split samples, and results in a remedial footprint that is a factor of 2 to 3 greater than the estimate in the SRI and ASTM.

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Table 3. Sensitivity of remedial footprint estimates to correction of supplemental RI data.

Correction Factor Applied to SRI Data	Area With Surface Total Aroclors Exceeding 11 mg/kg (Acres)	Increase Relative to Natural Neighbor[1]	Increase Relative to Ordinary Kriging[2]
1	116	NA	112%
1.25	148	27%	171%
1.5	171	47%	213%
2	206	77%	277%

Notes:
1) Area for the natural neighbor interpolation was based on the combined RI and SRI data.
2) Area with surface total Aroclors exceeding 11 mg/kg based on the ordinary kriging model was 54.6 acres based solely on the uncorrected SRI data.

Discussion

In addition to resolving issues with the SRI dataset, EGLE's recommendation is that the group pursue PCB quantification using a high resolution (Method 1668 – TPCBs as congeners [M1668]) or an intermediary method (e.g., Method 680 – TPCBs as Homologs [M680]), that would lower detection limits and provide increased accuracy of the TPCB quantification relative to M8082. Given the cost differences between M1668 and M8082, a defensible, site-specific predictive relationship between M8082 and M1668 could be developed and used to adjust M8082 results to a TPCB concentration so that the more cost-effective analytical method (M8082) could be utilized[37]. Alternatively, the use and adoption of M680, which is less rigorous and costly than M1668, could be explored if there is a strong predictive relationship between M680 totals and M1668 totals[38], and this has been done successfully at another Superfund site[39].

Risk and regulatory thresholds at the Site are based on TPCBs[40] and timeframes to achieve goals may be far into the future, so accurate and precise measurements of TPCBs in all media and across time and space is paramount to the implementation of a protective and effective remedy. If TPCB measurements are inaccurate and biased low, the nature and extent of contamination and perceived risks may be underrepresented, remedial footprints will be artificially reduced, design and cost estimates for remedies will be incomplete and inaccurate, and removal actions and remedies that are implemented will not achieve their anticipated level of risk reduction.

Human Health Risk Assessment – TPCBs and TTEQ

Introduction

EGLE's position is that the exposure assumptions in the HHRA should be updated and utilized to generic site-specific criteria for TPCBs and TTEQ to protect recreationalists, and smaller exposure areas ("homeranges") should be applied. The proposed TTEQ PRG for human health (990 parts-per-trillion [ppt]) is EGLE's Part 201 generic CUL for soil based on a non-residential exposure scenario and does not utilize the same site-specific exposure assumptions that are being used to develop and apply the 23 ppm TPCB PRG for human health, which themselves are outdated. The proposed exposure area ("homerange") for application of the recreational PRGs is 2 acres[10], which is significantly larger than a "homerange" that would be expected based discussions with the land manager about the current and potential future use for the majority of the property[24,35].

Background

Following the presentation of TTEQ RBCs to protect recreationalists in the Area 4 SRI, EGLE toxicologists reviewed the derivation of the proposed TTEQ RBCs and also revisited the TPCB RBC for recreationalists which was developed during 2003 HHRA. EGLE toxicologists generated TTEQ RBCs based on the existing recreational exposure assumptions in the 2003 HHRA and TPCB and TTEQ RBCs using updated exposure assumptions, which included adding exposures for children and adjusting certain parameters (such as State-specific climatological data) that has been collected since the time of the 2003 HHRA and are currently utilized when developing Site-specific criteria in the state. Using exposure assumption in the 2003 risk assessment EGLE toxicologists derived a TTEQ RBC of 400 ppt to protect recreationalists and TPCB and TTEQ RBCs of 6 ppm and 350 ppt, respectively, when using the updated exposure assumptions- all of which are based EGLE's statutory requirement of a 1 in 100,000 cancer-risk.

Discussion

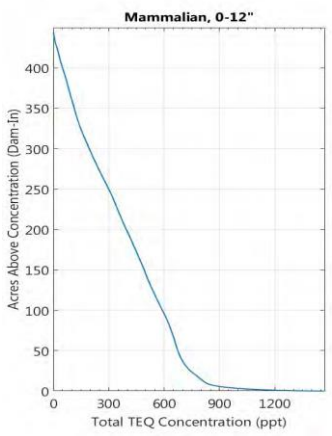
A calculated RBC for TPCBs drops from 23ppm to 6ppm when updating exposure assumptions in the 2003 HHRA to those currently used by EGLE. When using assumptions in the 2003 HHRA and updated exposure assumptions currently used by EGLE, the calculated RBCs for TTEQ are 400 ppt and 350 ppt, respectively, which is substantially lower than the proposed PRG of 990 ppt. As shown in the mammalian TTEQ plots below from the ASTM, there are substantially more acres above a TTEQ concentration of 350 ppt to 400 ppt (approximately 200 acres) than there are above 990 ppt (approximately 0 acres). The updated assumptions are not being used to calculate PRGs for recreational receptors, but the exercise provides value by showing that recent changes in our rules and science drive cleanup values for recreation down relative to assumptions included in our original assessment and meaningfully larger remedial footprints to protect recreationalists could be justified.

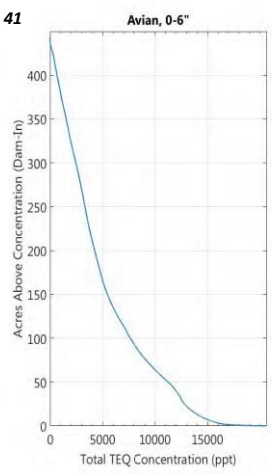
Discussions with MDNR suggest that an exposure area ("homerange") for recreationalists might be on the order of a quarter-acre to a half-acre in size based on the current management and use of the property, which is a State Game Area and mostly includes hunting of waterfowl and other wild game (i.e., deer, turkey, etc.), trapping of small game (i.e., muskrat, mink, etc.), and fishing from the riverbank. This is substantially smaller than the 2 acre "homerange" that is proposed. The FS must justify the proposed 2 acre "home range" and should evaluate the impact of selecting smaller "homeranges" (i.e., ¼ acre, ½ acre, 1 acre, etc.) on the remedial footprints so the risk manager can make an informed decision. As mentioned, use of the property generally includes hunting and trapping of wild game, many of which are ultimately consumed, and this exposure pathway remains a key data gap that should be assessed prior to or during the FS.

Ecological Risk Assessment – TTEQ

Introduction

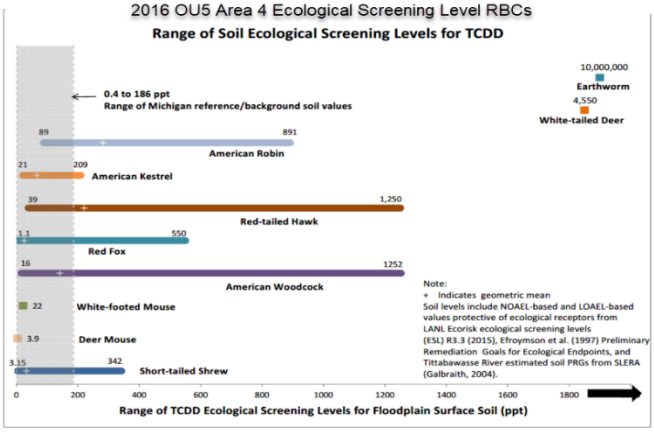
EGLE's position is the proposed PRGs for TTEQ for birds (7,000 ppt) and mammals (1,000 ppt) are not protective and the remedial footprints associated with these PRGs will leave a significant quantity of contaminated material in the environment. The high-end range of RBCs for birds and mammals that are presented in the TBERA were developed using toxicity reference values (TRVs) from Nosek et al. (1992) and Sparchu et al (1971), respectively, which were studies that were based on acute toxicity and did not consider bioaccumulation. EGLE's position is that the RBCs for birds should be derived based on the no-observable-adverse-effect-level (consistent with the process for mammals), which we estimate to be 375 ppt TTEQ; and the protective RBC range for mammals is 185 ppt to 1,853 ppt (central tendency = 585 ppt).

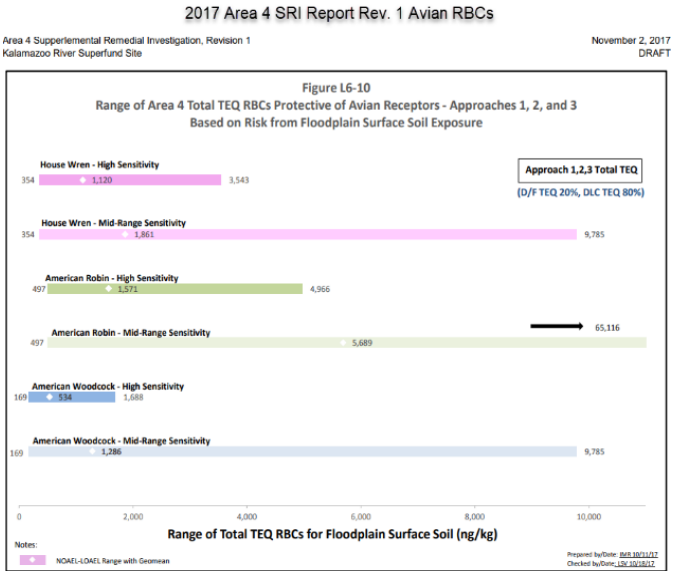


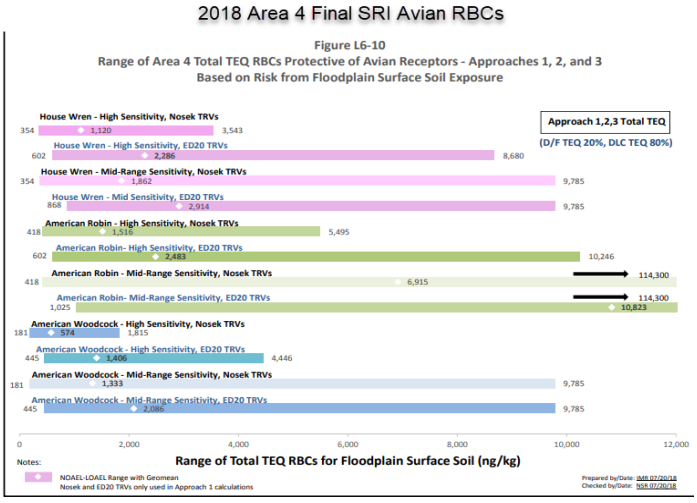


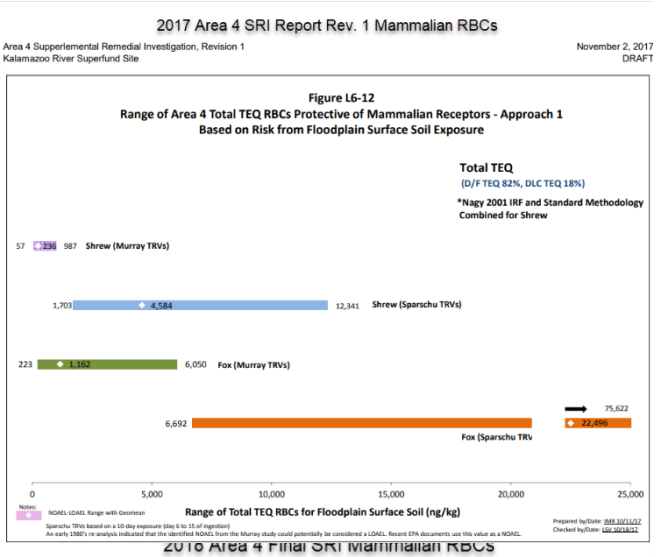
Background

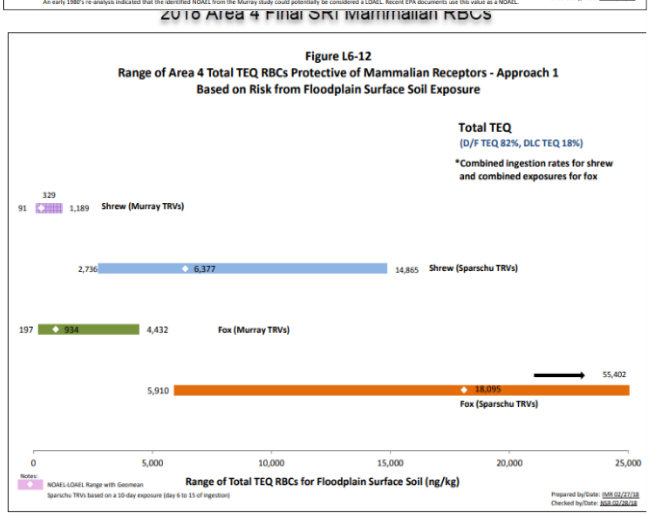
In Area 4 ecological exposure to TTEQ is a secondary but significant risk to terrestrial receptors and TTEQ risks extend outside of footprint developed for TPCBs, so it is necessary to incorporate a terrestrial baseline ecological risk assessment (TBERA) for TTEQ into the existing TBERA for TPCBs which is presented as Appendix L of the SRI Report[21]. The TBERA for TTEQ evolved throughout the SRI process, which took place over a period of four years and included three versions of the SRI Report, and figures showing the TTEQ RBCs for birds and mammals in each iteration of the TBERA and SRI Report are included below.











Discussion

Ecological risk assessment guidance states that that reproduction, growth, and survival are the key endpoints for consideration, and hierarchy of preference is given for chronic effects (e.g., lifetime, multigenerational) over sub-chronic (less than lifetime) effects, over acute, short-term effects[44]. The RBCs for birds and mammals were derived based on inappropriate toxicity values from acute, short-term studies which yield a wide range of RBCs for birds (181 ppt to 114,300 ppt) and mammals (91 ppt to 55,402 ppt). These values are also significantly higher than RBCs in the published literature and those used at a similar NPL site in Michigan (Tittabawassee River), which range from 89 ppt to 891 ppt for birds and 3.15 ppt to 550 ppt for mammals.

The high-end of the range of RBCs for mammals uses a TRV derived from Sparchu (1971) that is based on an acute (10 day) exposure of pregnant female rats and does not consider males in the reproduction process or bioaccumulation over time. The lowest-observed-adverse-effect-level (LOAEL) TRV for mammals showed significant mortality at 100 ppt, yet the TBERA derives a mammalian RBC range that reflects doses up to 750 times that exposure. The low-end of the range of RBCs for mammals was developed appropriately using a TRV from Murray et al. (1979) that is based on a year-long 3-generation study including males and females, with continuous feeding exposure, and rats were allowed to reach tissue steady-state prior to mating, meaning sperm and egg development effects were included. The selected PRG for TTEQ of 1,000 ppt for mammals is significantly higher than the central tendency value for ecological receptors and values needed to protect recreationalists based on site-specific exposure assumptions (350 ppt to 400 ppt) but is within the upper range of RBCs developed using the TRV from Murray (1979).

The avian TRVs derived from Nosek (1992) are not protective of birds, because they are acute lethality values. The TBERA TTEQ TRVs for birds derived from Nosek (NOAEL=14 ng TEQ/kg/day and LOAEL=140 ng TEQ/kg/day) is based on nearly complete (98%) mortality of eggs and did not appropriately consider bioaccumulation, yet the TBERA derives an avian RBC range that reflects doses up to 500 times higher than the avian acute LD_{50}. Therefore, using the LOAEL TRV to derive RBCs means any cleanup based on those values will potentially result in nearly complete egg mortality for invertivorous birds. If the Nosek paper is used to generate TRVs, EGLE's position is that the RBCs for birds should be derived using a NOAEL-based approach (consistent with how the mammalian PRG was determined), which we estimate to be 375 ppt TTEQ. Alternatively, EGLE previously provided a separate analysis as part of our comment letter on the SRI Report[46] showing how bioaccumulation could be accounted for in the Nosek LOAEL TRV and used to recalculate a RBC for birds that considers body burden, which produced TTEQ RBCs that range from 253 ppt to 925 ppt (central tendency = 484 ppt).

Significant data gaps that form the basis for sensitive parameters in the TBERA for TTEQ should be resolved, which includes the development of a site-specific bioaccumulation factor (BAF) based on co-located soil and earthworm samples. Earthworm BAFs are the foundation of, and the risk driver for, the derivation of RBCs. The earthworm BAFs in the TBERA were derived through a very complex set of mathematical manipulations performed on only two soil samples from a site in Sonford, MS, and appear orders of magnitude too low. Given the sensitivity and site-specific nature of this parameter, and the relatively low-level of effort that would be needed to resolve this data gap, there is no reason this should not be resolved before the FS and used to verify or adjust key assumptions in the TBERA. Additionally, EGLE is still unable to reproduce key calculations in the TBERA and the RPs are unwilling to provide fully functional and unlocked spreadsheets for risk assessment calculations, which they view as *proprietary*[47]. To support Agency review and for increased transparency, unlocked and fully functional copies of spreadsheets used to support risk assessments must be provided.

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